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The Canadian Productivity Review

Productivity Growth in Canadian and U.S. Regulated Industries

by Wulong Gu and Amélie Lafrance

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0[s]	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published

The Canadian Productivity Review

The Canadian Productivity Review is a series of applied studies that address issues involving the measurement, explanation, and improvement of productivity. Themes covered in the review include, but are not limited to, economic performance, capital formation, labour, prices, environment, trade, and efficiency at both national and provincial levels. The Review publishes empirical research, at different levels of aggregation, based on growth accounting, econometrics, index numbers and mathematical programming. The empirical research illustrates the application of theory and techniques to relevant public policy issues.

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Abstract

This paper compares the productivity growth of a set of Canadian and U.S. regulated industries. Using data from Statistics Canada's KLEMS database and the U.S. Bureau of Economic Analysis, the paper examines productivity growth in transportation services (which includes air and rail), broadcasting and telecommunications, and financial services (which includes financial intermediation and insurance), over the period from 1977 to 2003. The majority of these provide the foundational networks on which other industries rely. These sectors were quite heavily regulated in Canada at the beginning of the period of study (1977), experienced partial deregulation during the period and still faced various types of regulation at the end (2003). Deregulation also occurred in the United States, but regulation has generally been less restrictive there over most of the period.

The evidence shows that many of the Canadian industries that underwent deregulation experienced faster labour productivity growth and multifactor productivity growth than did the aggregate Canadian business sector and had similar or higher productivity growth than did their counterparts in the United States over the 1977-to-2003 period. Those industries include rail transportation, broadcasting and telecommunications, financial intermediation and insurance carriers. The airline industry had slower productivity growth in Canada than in the United States over the 1977-to-2003 period.

Keywords: productivity, regulation, foreign direct investment, network industries

Executive summary

Recent research for member countries of the Organization for Economic Co-operation and Development (OECD) has suggested that "productivity growth is boosted by reforms that promote private corporate governance and competition" (Nicoletti and Scarpetta 2003:10). Regulation is seen to create barriers to entry, reduce the incentives to innovation and investment, all of which lead to slower technological progress and slower productivity growth (Crafts 2006, Conway and Nicoletti 2007).

This paper examines the productivity growth performance of a group of regulated industries in Canada, and compares it with corresponding industries in the United States.

The industries examined here consist of transportation services, including rail and air; broadcasting and telecommunications; and financial services, including financial intermediation and insurance. They provide the foundational networks on which other industries rely. They are also industries that have traditionally faced regulation in terms of the pricing of products, the supply of industry outputs, and/or restrictions on foreign investment. In recent years, they have undergone some deregulation and experienced increases in competition.

Regulation is expected to affect the **level** of productivity. That is, heavily regulated industries are likely to be behind less regulated industries in other countries in terms of the level of their productivity. Deregulation is posited to affect the **growth** in productivity—by giving the productivity level of the industries being deregulated a boost towards that of their less regulated counterparts. During periods of deregulation then, productivity growth rates are expected to be particularly robust—both relative to other industries in the same country and relative to the same industries in other countries that have already experienced more deregulation.

This paper tests this hypothesis using Canadian and United States data that were especially constructed to provide comparable data for this study. Using Canadian KLEMS and U.S. Bureau of Economic Analysis data on four sectors of the economy that include transportation services, broadcasting and telecommunications, cultural industries and financial services, we examine labour productivity growth in these industries as well as the sources of growth in labour productivity (i.e., changes in capital intensity or multifactor productivity growth).

Most of Canada's main infrastructure industries are found to have experienced higher gains in labour productivity than the Canadian business sector as a whole from 1977 to 2003, and had similar or higher rates of growth than their counterparts in the United States.

In Canada, the growth in productivity ranged from an annual average rate of 1.4% in transportation services, to 2.9% in financial services to 4.4% in broadcasting and telecommunications during this 27-year period. These growth rates were higher than the Canadian business sector average (1.3%) over this period.

From 1977 to 2003, growth in labour productivity in the business sector as a whole was slower in Canada than in the United States. In Canada, labour productivity in the sector increased at an annual average rate of 1.3%, compared with 2.0% in the United States.

In contrast to the Canadian business sector, most infrastructure industries in Canada had higher, or comparable, growth in labour productivity than their American counterparts. These include rail transportation, financial intermediation, insurance as well as broadcasting and communications.

For example, the 2.7% rate of growth in financial intermediation in Canada was much higher than the gain of 0.5% in the United States. The gain in insurance was 3.5% in Canada but zero in the United States. Growth in rail transportation was about the same in the two countries.

On the other hand, productivity increased 4.6% in air transportation in the United States, well above the 0.2% rate in Canada.

In infrastructure industries where labour productivity growth was higher in Canada than in the United States, growth in both multifactor productivity and capital intensity was also higher than that in similar American industries, or comparable to it.

Productivity Growth in Canadian and U.S. Regulated Industries

by Wulong Gu and Amélie Lafrance

1 Introduction

Recent research for member countries of the Organization for Economic Co-operation and Development (OECD) has suggested that "productivity growth is boosted by reforms that promote private corporate governance and competition" (Nicoletti and Scarpetta 2003:10). Regulation is seen to create barriers to entry, reduce the incentives to innovation and investment, all of which lead to slower technological progress and slower productivity growth (Crafts 2006, Conway and Nicoletti 2007).

Similarly, in a series of cross-country case studies, the Mckinsey Institute has identified a lack of competition and regulation as one of the factors behind low productivity growth in many countries (see Kellison 2004). Many of the Mckinsey studies focused on restrictions on foreign investment, traditional utility-type regulation and urban planning restrictions that reduced retail and wholesale competition.

Since a number of studies have found that barriers to competition and regulation hinder productivity growth (though they may have other beneficial social purposes), the focus of our study is on the productivity performance of the 'regulated' infrastructure sector in Canada.

The main infrastructure industries that are examined here encompass transportation services, including rail and air; broadcasting and telecommunications; and financial services, including financial intermediation and insurance. They provide the foundational networks on which other industries rely. They are also industries that have traditionally faced regulation in terms of the pricing of products and the supply of industry outputs. In recent years, they have undergone varying degrees of deregulation and experienced increases in competition.

Productivity performance is important but it is just one of many indicators that analysts use to judge the performance of an economy. Productivity is a measure of the efficiency with which resources are turned into output. Growth in labour productivity is closely associated with growth in gross domestic product per capita and with increases in real wages over time in the Canadian economy (Baldwin and Gu, 2007c). Other aspects of an economy—the safety of the products produced, the volatility of the economic system, and the fairness of the distribution of income—require other statistics if analysts are to fully assess the many factors besides productivity that together affect an economy's overall health.[1]

Canada has sector-specific legislation and/or policies on foreign investment in telecommunications, broadcasting, cultural industries,[2] and transportation services. The financial services sector is subject to ownership restrictions, but not specific foreign-ownership restrictions. According to the OECD, Canada has the second greatest restrictions on foreign direct investment in the OECD countries (Maher and Shaffer 2005). The regulations are generally more restrictive in Canada than in the United States in non-manufacturing industries, including air transportation and telecommunications (Conway and Nicoletti 2006).

These sectors were quite heavily regulated in Canada at the beginning of the period of study (1977), experienced deregulation at different times during the period and still faced various types of regulation at the end (2003).

1. Gray (1987), for example, demonstrates that environmental regulations in the U.S. negatively affected productivity growth—though presumably they benefited the environment.
2. As a result of a request by the Review Panel's staff, we included culture industries in addition to the main infrastructure network industries in this study.

Deregulation also occurred in the United States, but regulation has generally been less restrictive there over most of the period.

Regulation is expected to affect the **level** of an industry's productivity. That is, heavily regulated industries are likely to be behind less regulated industries in other countries in terms of the level of their productivity. Deregulation is posited to give the regulated industries a boost, that is, their productivity **growth** is expected to increase the relative productivity level towards that of their less regulated counterparts as they partially or fully 'catch up' to them. During periods of deregulation then, productivity growth rates are expected to be particularly robust—both relative to other industries in the same country and relative to the same industries in other countries that have already experienced more deregulation.

This paper tests this hypothesis by asking whether productivity growth of the Canadian regulated infrastructure industries has been especially robust relative to other Canadian industries and to their U.S. counterparts.[3]

The paper is organized as follows. In Section 2, we outline the data used for the international comparison. In Section 3, we examine labour productivity growth in the regulated industries in Canada. Section 4 provides a comparison of labour productivity growth in Canadian and U.S. regulated industries. Section 5 compares multifactor productivity growth and capital deepening in the regulated industries in the two countries. Section 6 concludes the paper.

2 The data

This paper examines the growth in output and labour productivity in regulated industries in Canada and in the United States over the period from 1977 to 2003. The industry definitions for the regulated industries are based on the 1997 North American Industry Classification System (NAICS). The industries that will be examined include two transportation services industries (rail transportation and air transportation); two cultural industries (publishing, data processing and information services; and motion pictures and sound recording industries); two financial services industries (financial intermediation including monetary authorities and credit intermediation,[4] and insurance carriers);[5] and the broadcasting and telecommunications industry. In addition, we will also examine the transportation and warehousing sector as a whole, which includes air and rail transportation, as well as water, truck and pipeline transportation.[6] All of these industries, with the possible exception of the cultural sector, play a foundational network role for industries in the rest of the economy.

The regulated industries examined in this paper accounted for about 16% of the total business sector's gross domestic product (GDP) in 2003 (Table 1). Over the 1977-to-2003 period, there was little change in the share of these regulated industries in the total business sector. The share of air transportation and rail transportation in the business sector declined. The share of the two cultural industries and financial intermediation in the business sector increased, while the share of the remaining regulated industries (broadcasting and telecommunications and insurance carriers) was unchanged over the period.

3 Additional studies of the impact of regulation might try to capture whether turning points in productivity growth could be identified with specific regulatory events and whether other factors in the underlying technology also favoured the regulated sector in Canada that might have had a greater stimulating effect on them than on their counterpart U.S. industries. But these issues were beyond the scope of this study.

4 The financial intermediation industry in Canada and the United States includes the industry depository credit intermediation and no related activities of the North American Industry Classification System; but the U.S. category includes non-depository credit intermediation as well. This is not deemed to be a problem for the comparisons presented in the paper since non-depository credit intermediation makes up only 10% of credit intermediation in the United States.

5 The insurance carriers for the United States include related activities that make up a small portion of the insurance industry.

6 The reader should be warned that international comparisons of productivity need to be cognizant of differences in methodologies and sources; see Baldwin et al. 2005.The authors have done their best in this study to use data that are as comparable as possible, but nevertheless there may be some differences that affect the quality of the comparisons reported herein.

Table 1
The share of regulated industries in nominal gross domestic product of the Canadian business sector, 1977 and 2003

	1977	2003	Change
	percent		
Transportation and warehousing	6.7	5.6	-1.1
Air transportation	0.7	0.4	-0.3
Rail transportation	1.5	0.6	-0.9
Broadcasting and telecommunications	2.8	2.8	0.0
Publishing, data processing and information services	0.8	1.2	0.5
Motion picture and sound recording industries	0.1	0.3	0.2
Financial intermediation	2.7	4.0	1.3
Insurance carriers	1.6	1.5	-0.1

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

2.1 Canadian data

The data for Canada are taken from the Canadian KLEMS database. The database provides time series data for multifactor productivity, output and inputs including capital, labour, energy, materials and purchased services in the new NAICS back to 1961 (Baldwin, Gu and Yan 2007). For the purpose of this paper, we will use GDP as the measure of output, hours worked and net capital stock as measures of labour and capital, in order to be comparable with the data used for the U.S. industries. The data for the Canadian business sector are taken from CANSIM Table 383-0021.

2.2 U.S. data

The data for the regulated industries in the United States are obtained from the U.S. Bureau of Economic Analysis (BEA). For the output measure, the BEA publishes chain-type volume indexes for value added. For the labour measure, the BEA publishes data on persons engaged in production that include paid workers and self-employed workers for the 1998-to-2003 period; it also publishes data on full-time and part-time paid workers for the period prior to 1998. The two measures are linked to form a time series of the persons engaged in production for the period from 1977 to 2003. This is appropriate, as there is very little self-employment in these industries and the trend between persons engaged in production and the number of full-time and part-time workers is very similar for the industries examined in this paper over the 1998-to-2003 period. Finally, the number of persons engaged in production in an industry is multiplied by the hours worked per person engaged in production in the same industry from the EU KLEMS database to obtain the number of hours worked (Timmer, O'Mahony and van Ark 2007).

The investment data by industry are obtained from the BEA (Lally 2004). The data are based on NAICS and contain investment for 47 asset categories. The capital stock of each asset category for U.S. industries is then estimated using the perpetual inventory method by assuming a geometric depreciation pattern. To ensure the measures of capital stock in the United States are comparable with those in Canada, we have used the depreciation rates that are used in the Canadian KLEMS database (for details, see Baldwin et al. 2008).

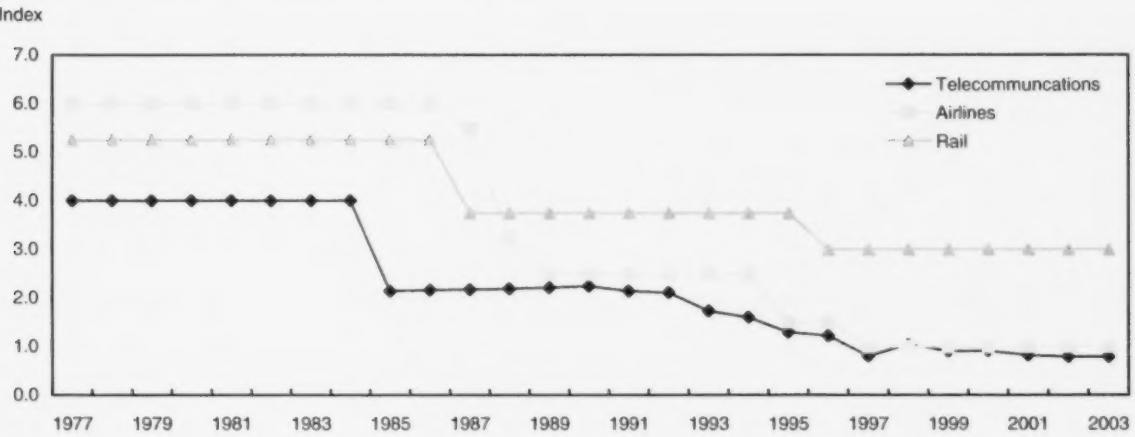
3 Labour productivity trends in the regulated industries in Canada

In this section, we examine the output and productivity growth of the regulated industries over the 1977-to-2003 period. We begin by discussing the regulatory framework in each industry.

3.1 Structural reforms and deregulation in the regulated industries in Canada

Throughout the period since the 1970s, there has been a trend toward deregulation within Canadian regulated industries. A number of structural reforms were implemented in the late 1980s across a range of the regulated industries (Conway and Nicoletti 2006). The Organisation for Economic Co-operation and Development (OECD) publishes regulation indicators in energy, transport and communications that measure restrictions to competition. These indicators capture factors such as barriers to entry, state ownership and market structures in the industry, although they do not reflect restrictions to foreign ownership.[7] For example, in telecommunications, the indicator is based on the market share of new entrants to gauge the extent to which regulators succeeded in promoting competition (Conway and Nicoletti 2006). Chart 1 illustrates these indicators for air transportation, telecommunications and rail transportation over the 1977-to-2003 period. Restrictions to competition are based on a scale of 0 to 6, where an indicator of 6 signifies that there are heavy restrictions to competition in the industry.

Chart 1
Regulation index by industry in Canada



Note(s): The regulation index is based on a scale from 0 to 6, from the least to the most restrictions on competition.
Source(s): Organisation for Economic Co-operation and Development.

Both the airline and the rail industries were largely deregulated in 1988 with the emergence of the *CanadaTransportation Act*. This Act entitled all licensed domestic air carriers to operate freely in southern Canada, and this right was then extended throughout the country in 1996. However, there are restrictions on foreign ownership in the airline industry, and there remain controls preventing foreign carriers from competing on domestic routes. Under the *Canada Transportation Act*, ownership and control of voting interests held in a Canadian air carrier by non-Canadians may not exceed 25%.

The telecommunications industry consists of wired or wireline (the largest segment) and wireless telecommunications carriers as well as satellite telecommunications, while the broadcasting industry comprises radio and television broadcasting, as well as pay and specialty television. With the introduction of technological advances, both telecommunications and broadcasting have experienced dramatic changes in the last decade. Changes in the telecommunications services sector include the liberalization of the terminal equipment market (1980 to 1982), the launch of cellular service (1985), facilities-based long distance (1992) and fixed satellite services (2000). Changes to the broadcasting industry include the introduction of pay TV and specialty services (1983) and the launch of digital networks (2002).

7. For further explanation of these indicators, please refer to Conway and Nicoletti (2006).

According to the OECD, Canada started early, relative to most OECD countries, in implementing competitive reforms to its telecommunications policy and regulatory regime. The *Telecommunications Act* of 1993 installed a more flexible regulatory framework to foster competition. Canada has had open-market entry in all telecommunications services since the end of 1998 (although a licence is required for wireless operators and international service providers), and its telecommunications industry is considered to be one of the most pro-competitive in OECD countries (Maher and Shaffer 2005). However, Canada is one of six OECD countries that have restrictions on foreign ownership in public telecommunications operators.

The rules regarding foreign ownership require majority ownership and control of Canadian broadcasting entities by Canadians; however, at least 40% of television content is not produced in Canada. Broadcast program distribution was opened to competition in 1997, which allows cable firms to face competition from direct-broadcast satellites. Since then, cable operators have been able to change their basic cable rates without seeking approval from the Canadian Radio-Television and Telecommunications Commission.

In cultural industries, policies generally prohibit the acquisition of an existing Canadian-owned business and they prohibit or set conditions for the establishment of new businesses, particularly in most types of publishing. Canada has sought to restrict access to U.S. press, television and radio with cultural trade restrictions, although this policy is not unique to Canada. Although restrictions exist, in many cases, foreign-owned companies dominate the culture industries in terms of sales.

The financial intermediation industry consists of activities related to the central bank and depository institutions such as commercial banks and credit unions. This industry has experienced many changes in its regulatory regime since the early 1980s, particularly because of changes made to the *Bank Act*, which is subject to review every five years. In 1987, amendments were made to federal legislation to permit Canadian banks to invest in corporate security dealers. In 1999, federal legislation allowed foreign banks to establish specialized, commercially focused branches in Canada, although foreign-bank branches were restricted in accepting deposits of at least $150,000. Previously, they were required to establish separate Canadian subsidiaries. Following this change, many foreign-bank subsidiaries converted into foreign-bank branches. In 2001, reforms were made to the *Bank Act* to encourage increased competition and accountability, such as allowing banks to own finance companies. The insurance carriers industry consists of the markets for life insurance and pensions, health and accident insurance and property and casualty (P&C) insurance. Both federal and provincial levels of government regulate the insurance industry. Over 90% of firms in the life and health insurance sector and over two thirds of firms in the P&C sector are regulated by the Government of Canada under the *Insurance Companies Act*. All insurers are subject to market conduct regulation by the province in which they carry on business. In 2001, federal legislation allowed insurers to set up holding companies and gain access to Canada's national payments system.

3.2 Output and labour productivity growth in the regulated industries in Canada

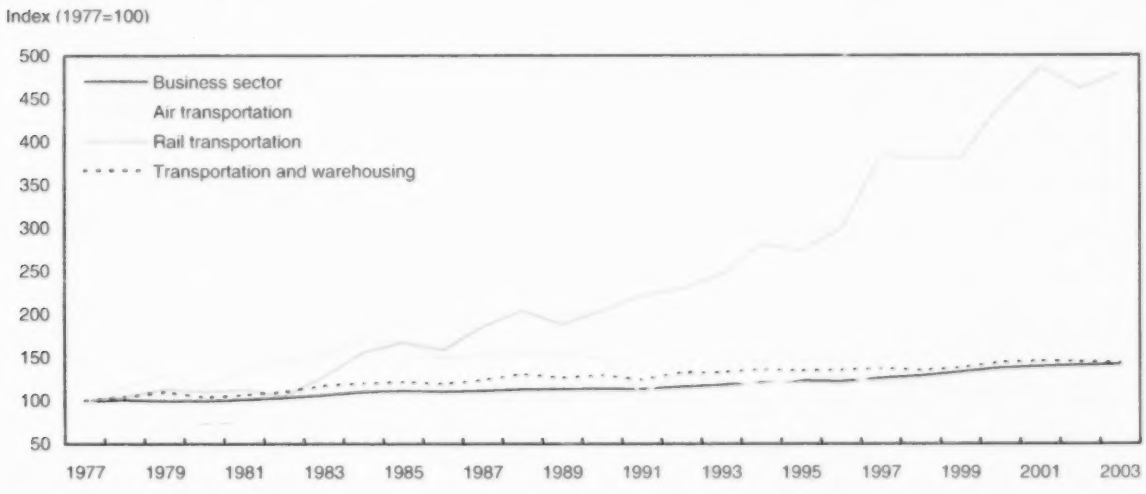
Table 2 presents annual labour productivity growth in the network industries and the total business sector in Canada over the 1977-to-2003 period. Charts 2 to 5 plot labour productivity in those industries over the period. Compared with the business sector, labour productivity growth was relatively high in most of the regulated industries, except in the two cultural industries and air transportation. Over the period from 1977 to 2003, labour productivity growth was rapid in rail transportation, broadcasting and telecommunications and both financial services industries. While labour productivity in the business sector rose at a rate of 1.3% in the period, it grew at a much higher rate in most regulated industries, ranging from 2.7% per year in financial intermediation to 6.2% per year in rail transportation.

Table 2
Annual labour productivity growth in the regulated industries in Canada

	1977 to 1990	1990 to 2003	1977 to 2003
	percent		
Transportation and warehousing	2.0	0.8	1.4
Air transportation	3.1	-2.6	0.2
Rail transportation	5.7	6.8	6.2
Broadcasting and telecommunications	5.1	3.8	4.4
Publishing, data processing and information services	0.4	0.4	0.4
Motion picture and sound recording industries	1.8	-0.4	0.7
Financial intermediation	2.2	3.3	2.7
Insurance carriers	5.6	1.4	3.5
Total business sector	**1.0**	**1.7**	**1.3**

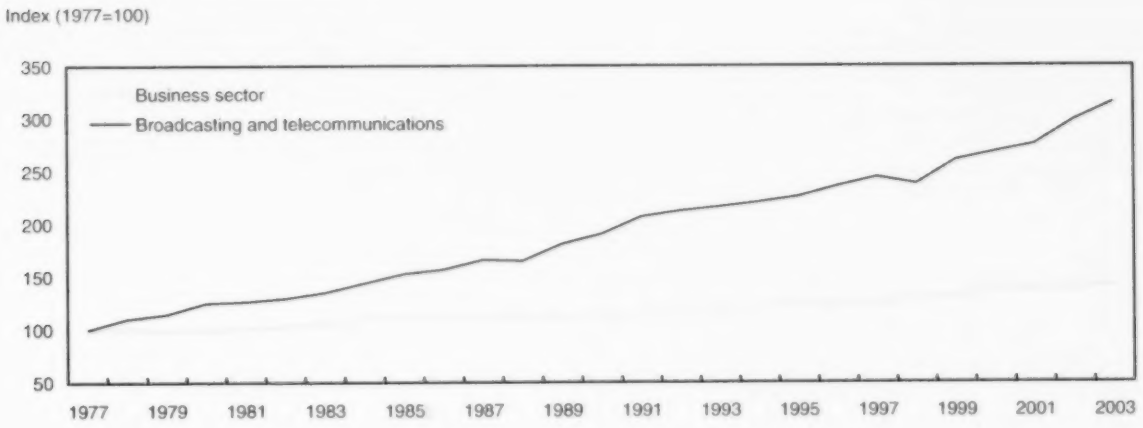
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

Chart 2
Labour productivity in transportation industries



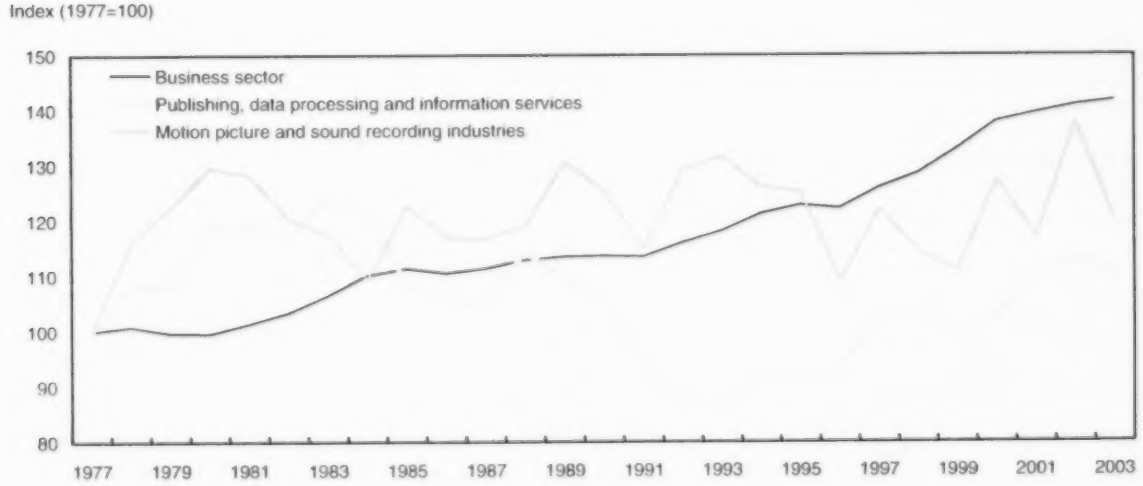
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

Chart 3
Labour productivity in broadcasting and telecommunications



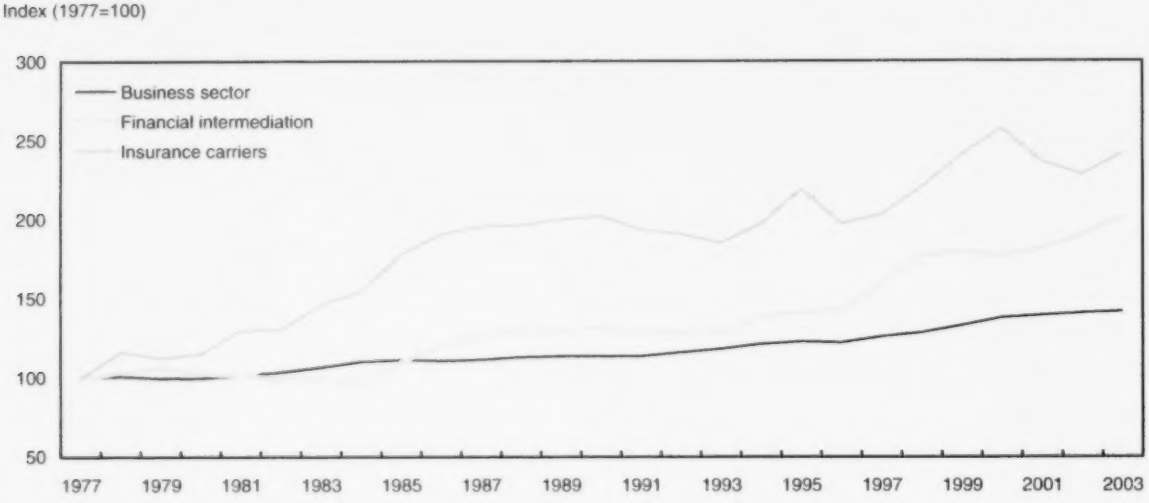
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

Chart 4
Labour productivity in the cultural industries



Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

Chart 5
Labour productivity in the financial services



Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

The strong productivity performance in the industries that have been deregulated supports the empirical evidence from the OECD, European Union and the United Kingdom that deregulation is associated with higher productivity growth, possibly through the reduction in barriers to entry, increases in incentives to innovation and adoption of advanced technologies (Copenhagen Economics 2007, European Commission 2004).

The two cultural industries (publishing, data processing and information services; and motion pictures and sound recording) and air transportation have had much slower productivity growth than the business sector. The Canadian cultural industries were the industries that experienced less deregulation than most of the other industries studied here.[8] The slower productivity growth in air transportation occurred during a time when Canada experienced a recession in the early 1990s, the effects of 9/11 and a surge in oil prices.

Tables 3 and 4 present the annual growth in real gross domestic product (GDP) and hours worked in the regulated industries and the total business sector in Canada over the 1977-to-2003 period. Output growth was relatively high in most regulated industries, except in air and rail transportation. The growth in hours worked in the two cultural industries was much higher than that in other network industries and the total business sector.

8 These industries may also be subject to greater measurement problems when it comes to the price data that are used to generate output growth from revenue data.

Table 3
Annual growth of real gross domestic product in the regulated industries in Canada

	1977 to 1990	1990 to 2003	1977 to 2003
	percent		
Transportation and warehousing	3.9	2.5	3.2
Air transportation	6.6	-2.5	2.0
Rail transportation	1.5	4.1	2.8
Broadcasting and telecommunications	6.8	5.1	6.0
Publishing, data processing and information services	4.9	4.1	4.5
Motion picture and sound recording industries	6.2	5.2	5.7
Financial intermediation	4.7	4.1	4.4
Insurance carriers	5.8	1.3	3.6
Total business sector	**3.2**	**3.1**	**3.1**

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

Table 4
Hours worked growth in the regulated industries in Canada

	1977 to 1990	1990 to 2003	1977 to 2003
	percent		
Transportation and warehousing	1.8	1.7	1.8
Air transportation	3.4	0.1	1.7
Rail transportation	-4.0	-2.5	-3.3
Broadcasting and telecommunications	1.7	1.3	1.5
Publishing, data processing and information services	4.5	3.7	4.1
Motion picture and sound recording industries	4.4	5.6	5.0
Financial intermediation	2.5	0.8	1.7
Insurance carriers	0.2	0.0	0.1
Total business sector	**2.2**	**1.3**	**1.8**

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021.

The rest of this section presents a more detailed examination of output and labour productivity growth in the regulated industries over the 1977-to-2003 period. The transportation and warehousing sector, as a whole, has experienced stronger growth than the business sector over the period from 1977 to 2003. The airline industry experienced strong output and labour productivity growth until 1991. The Canadian airline industry was greatly affected by the recession of 1991. Following this recession, the industry's output grew at a stronger pace than the business sector until 1998. Thereafter, the industry was unable to keep up with the business sector. Slow economic growth in 2000 and 2001 further dampened the industry's output growth and labour productivity. After 2000, the industry continued to experience further disruptions, including the effects of 9/11, surges in oil prices and weather-induced flight delays.

The rail industry, consisting of freight and passenger railways, is not a high-growth industry. It has generally been growing at a slower pace than the business sector throughout the 1977-to-2003 period. However, since the privatization of Canadian National Railways (CN) in 1995, and further deregulation in 1996, the industry's output growth has doubled. Moreover, in 1998, CN purchased U.S. rail company Illinois Central Corp., which allowed the Canadian railway to connect its lines from Vancouver, British Columbia, to Halifax, Nova Scotia, with a line running from Chicago, Illinois, to New Orleans, Louisiana. This has led CN to increase its clientele and gain significant economies of scale. Labour productivity growth in the rail industry was higher than other industries in the transportation and warehousing sector, and higher than other industries examined in this analysis.

The broadcasting and telecommunications industry's performance has proven to be quite robust. The industry has never experienced negative output growth over the 1977-to-2003 period. Labour productivity growth in broadcasting and telecommunications was negative in only two years, 1988 and 1998, when hours worked increased significantly in both years.

The wireless telecommunications component has been growing quickly, particularly since the launch of cellular service. The number of wireless phones has been increasing rapidly. The number of mobile communication subscribers in 2003 was more than 10 times the number of subscribers at the end of 1993. Moreover, the rate of Internet subscriptions in Canada is one of the highest in the world, with 56 subscribers per 100 households in 2003. In broadcasting, the FM-radio segment is one of the most profitable in broadcasting. Much of the growth in television broadcasting over the last decade can be attributed to the rapid rise of pay and specialty television.

The publishing, data processing and information services industry consists of the publishers of newspapers, periodicals, books, databases and software, data processing services, and information services such as news syndicates, libraries and archives. Its GDP made up 0.78% of the business sector's GDP in 1977. This ratio jumped to 1.2% in 2003 (Table 1). However, labour productivity growth in this industry has been below that of the business sector.

The motion picture and sound recording industries include motion picture and video production, distribution and exhibition, and record production, integrated record production, music publishers and sound recording studios. They are quite small in relation to the business sector but they have expanded rapidly. Since 1997, there have generally been increases in service production for Hollywood films in the motion picture industry. The creation of the Canadian Film or Video Tax Credit in 1994, the Canadian Television Fund in 1996 and expansion of the broadcasting industry generated the need for more Canadian programming. Moreover, many new and large movie theatres have been built in recent years. On the other hand, the Canadian film market is fragmented into the markets for French-language and English-language Canadian productions. The industry in Quebec is largely subsidized, and there are barriers to entry in the French-language market in the form of laws stipulating that distributors interested in distributing films in Quebec must be based in the province, along with mandatory translation of foreign films. In terms of the sound-recording industries, according to the International Federation of the Phonographic Industry, Canada ranked sixth in terms of recorded-music sales in 2003. Similar to the publishing, data processing and information services industry, the motion pictures and sound-recording industries' labour productivity has not been growing as quickly as that of the business sector, particularly since 1994.

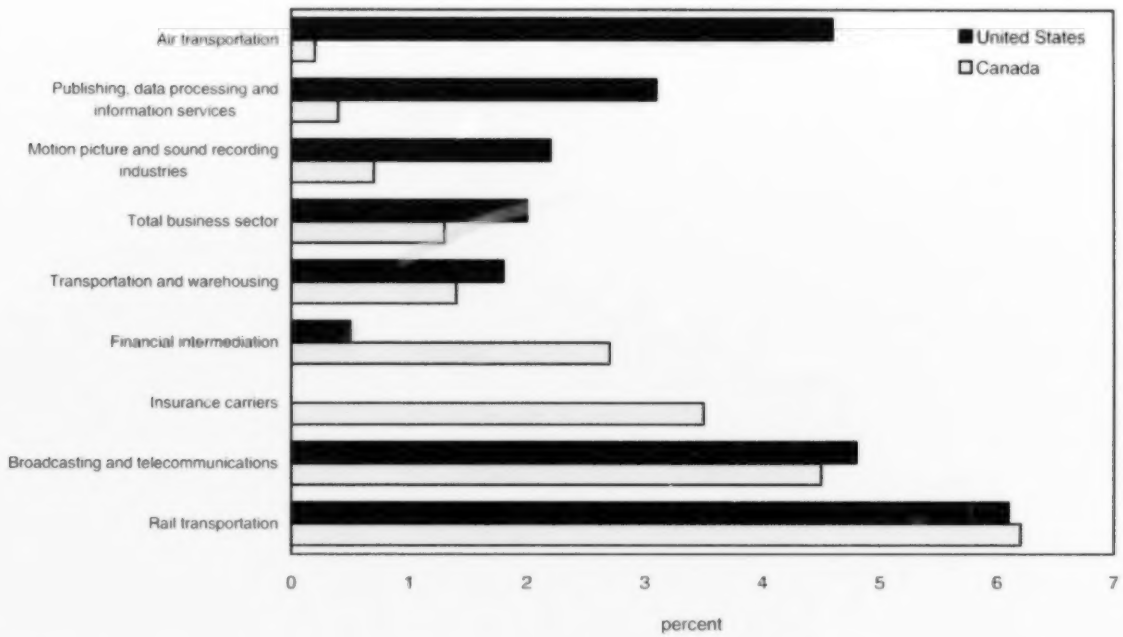
Labour productivity grew more quickly in financial intermediation and insurance carriers than in the business sector. While domestic banks and trust companies dominate the industry, the real value of services produced by foreign bank subsidiaries and branches has been growing quickly (Hinchley 2006), which has contributed to the industry's output growth.

4 Canadian–U.S. comparison of labour productivity growth in regulated industries

In this section, we compare output and labour productivity growth in Canadian and U.S. regulated industries over time. In the 1970s, the regulated sector in Canada was, in general, more heavily regulated than in the United States (Conway and Nicoletti 2006). Since the 1970s, there has been deregulation and open-market entry in both Canada and the United States, but at a faster pace in Canada. By the early 2000s, the gap between the severity of regulation in Canada as compared to the United States had been considerably reduced; the possible exception would be that of the cultural industries in Canada. The book publishing, distribution and retail sectors, the periodical publishing and newspaper sectors, and the film distribution sectors all have policy measures that generally prohibit the acquisition of an existing Canadian-owned business and prohibit or set conditions for the establishment of new businesses. In the United States, there are no rules preventing foreign ownership in the publishing industry, with the exception of newspapers (Price 2001).

Over the 1977-to-2003 period, labour productivity growth in the aggregate business sector was slower in Canada than in the United States. During that period, labour productivity grew at the rate of 1.3% per year in Canada while it grew at 2.0% per year in the United States (Chart 6). However, most regulated industries in Canada had higher or comparable labour productivity growth than their U.S. counterparts, except in the culture industries and air transportation. Over that period, labour productivity growth has been stronger in Canada than in the United States in financial services. In rail transportation and in broadcasting and telecommunications, labour productivity growth was similar in the two countries.

Chart 6
Annual labour productivity growth in Canadian and U.S. network industries, 1977 to 2003

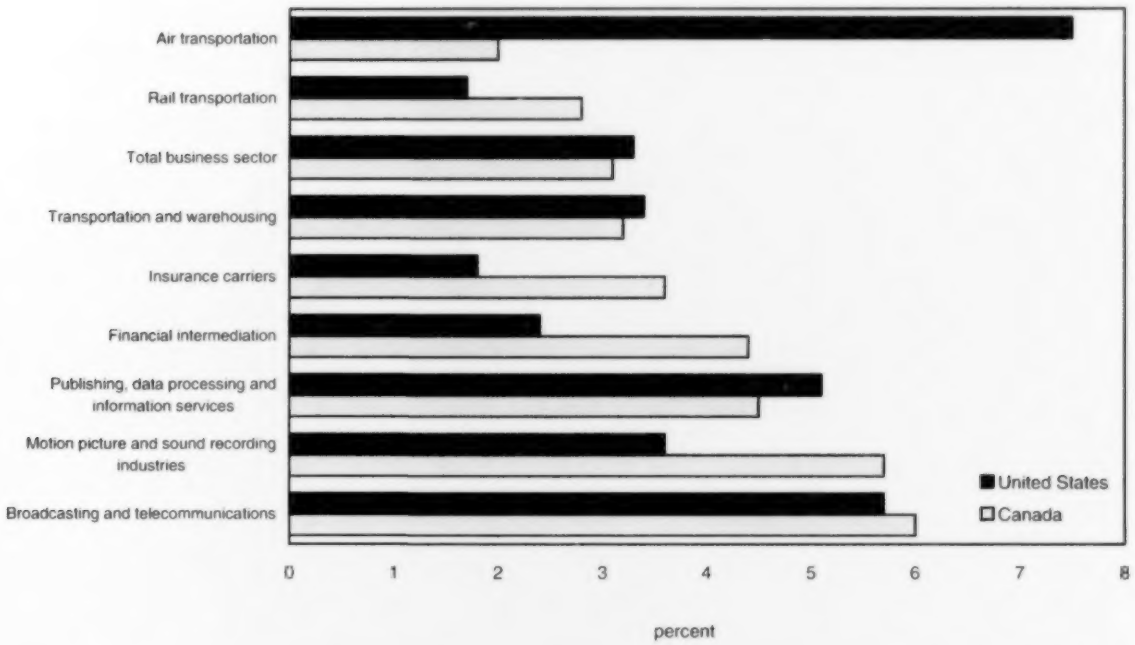


Note(s): The insurance carriers industry in the United States had practically zero labour productivity growth from 1977 to 2003, thus there is no bar.
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

The regulated industries that had a higher or comparable productivity growth relative to the United States are those industries where deregulation took place in Canada. The slow productivity growth in the Canadian cultural industries, which experienced less deregulation, stands in contrast to those industries where there was more deregulation.

Chart 7 presents the real gross domestic product growth in the regulated industries in Canada and the United States over the period from 1977 to 2003. Output growth in Canada was higher or comparable to that in the United States in almost all network industries, except in air transportation. Air transportation in Canada had much slower output growth than in the United States over the 1977-to-2003 period, which was due to slower growth in Canadian air transportation after the early 1990s.

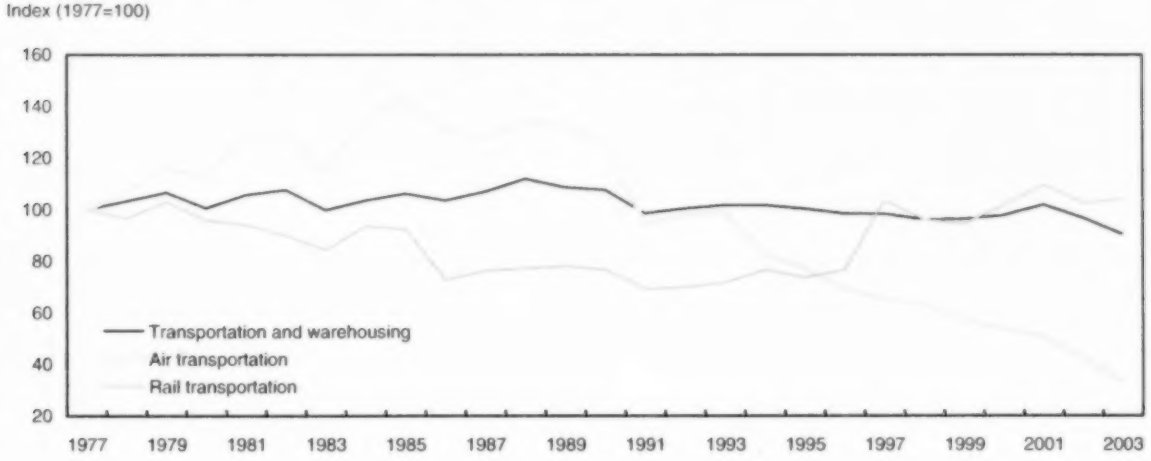
Chart 7
Annual output growth in Canadian and U.S. network industries, 1977 to 2003



Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

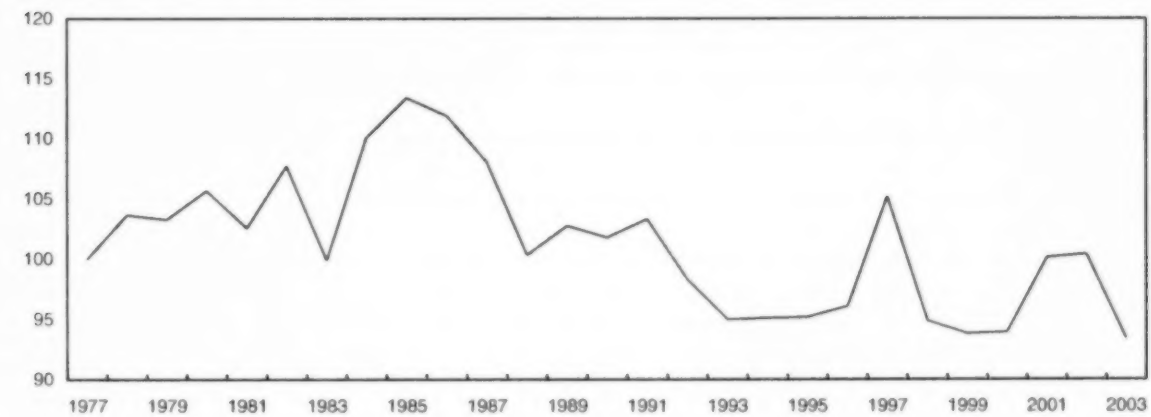
In the rest of the section, we provide a Canada–United States comparison of labour productivity growth in individual industries over time, as shown in Charts 8 to 11. These charts present the ratio of labour productivity in Canada to that in the United States (1977=100 for both countries). A reading above 100 implies that the relative Canada–United States productivity level has increased since 1977 to a level above the relative level in the base period. A decrease in the relative index implies that productivity growth in Canada has been slower than productivity growth in the United States. The slope of each line at a given year indicates the relative growth rates of labour productivity in the two countries.

Chart 8
Relative Canada–United States labour productivity ratio in transportation, 1977 to 2003



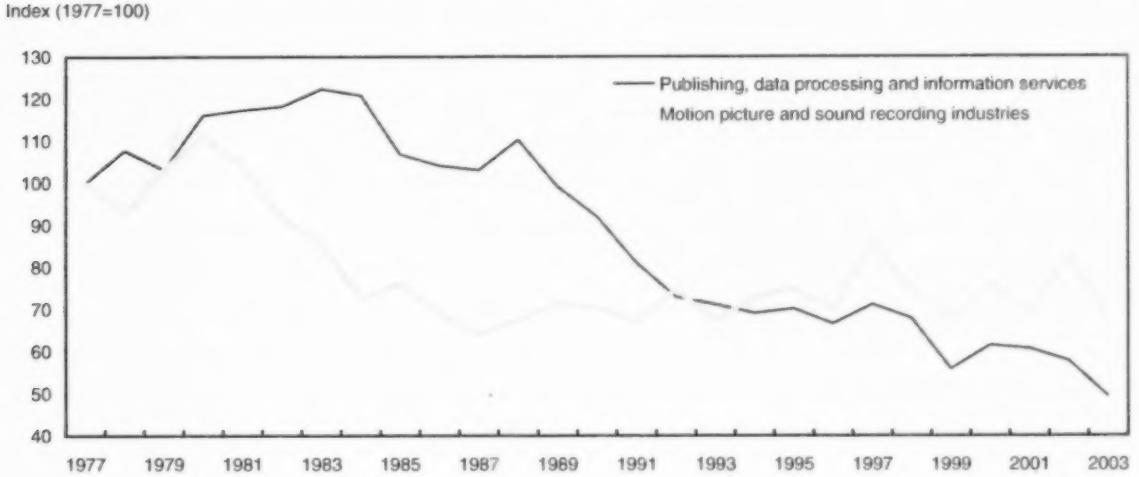
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

Chart 9
Relative Canada–United States labour productivity ratio in broadcasting and telecommunications, 1977 to 2003



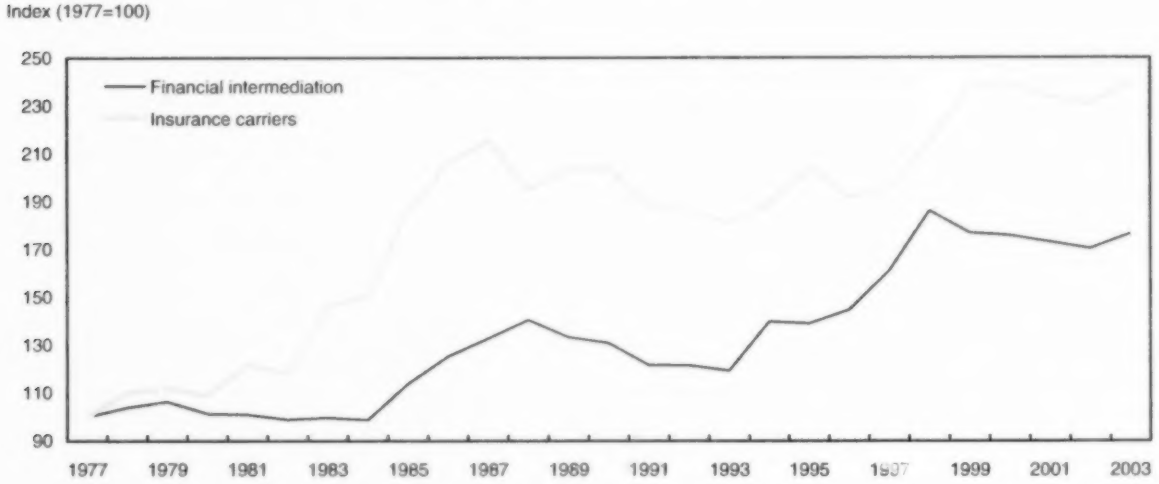
Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database; Bureau of Economic Analysis.

Chart 10
Relative Canada–United States labour productivity ratio in cultural industries, 1977 to 2003



Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database; Bureau of Economic Analysis.

Chart 11
Relative Canada–United States labour productivity ratio in financial services, 1977 to 2003



Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database; Bureau of Economic Analysis.

From 1977 to 1990, labour productivity growth was higher in Canada than in the United States in air transportation (Chart 8). After 1990, this situation reversed, with the United States leading in terms of labour productivity growth. Productivity growth has been particularly poor in the Canadian air transportation industry after 1990. On the other hand, the rail industry in Canada did not perform in the same manner as air transportation. There was a downward trend in the relative Canada–United States labour productivity ratio until 1990. Thereafter, the ratio increased, with the rail transportation industry in Canada growing more quickly than in the United States.

Labour productivity growth in broadcasting and telecommunications was similar in the two countries over the 1977-to-2003 period. Chart 9 shows that Canada led the United States until 1985, when the industry's labour productivity began to grow slightly more quickly in the United States.

In the publishing, data processing and information services industry, Canada outperformed the United States until the mid-1980s, as shown in Chart 10. Following that period, labour productivity in the United States grew faster than in Canada. For the motion picture and sound recording industries, labour productivity growth was slower in Canada until the mid-1980s. Thereafter, labour productivity growth was similar in the two countries.

Labour productivity growth in financial intermediation and insurance carriers was higher in Canada than in the United States in the 1977-to-2003 period (Chart 11). The ratio of Canadian to U.S. labour productivity showed a steady increase over the period for the two financial services industries. Alternative measures using other data sources have shown that productivity growth of Canadian banks has been higher than that of American banks in recent years (Allen and Engert 2007).

5 Investment and multifactor productivity growth in regulated industries in Canada and the United States

Labour productivity growth can be broken into two main components: gains that originate from changes in capital intensity (the amount of capital per hour worked); and growth in multifactor productivity (MFP), which is generally everything that cannot be accounted for by labour and capital. Growth in MFP is often associated with technological change, organizational change or economies of scale. In this section, we examine the sources of labour productivity growth in the regulated sector in Canada and the United States, and compare them in both countries over time. We will use a standard growth accounting technique:

$$\textbf{(1)} \qquad \Delta \ln\left(LP_t\right) = \Delta \ln\left(MFP_t\right) + \overline{s}_k \Delta \ln\left(\frac{K_t}{L_t}\right)$$

where Δ denotes the change between periods t-1 and t. LP is labour productivity defined as real gross domestic product (GDP) per hour worked, K/L is capital stock per hour worked, and $\overline{s}_k$ is the average share of capital income in nominal GDP in the periods t-1 and t.

The equation shows the two main sources of labour productivity growth. The first term is MFP growth, which increases labour productivity growth on a point-for-point basis. The second term on the right-hand side is the contribution of capital deepening (or capital deepening effect), whereby more capital services make workers more productive (for details on the growth accounting framework, see Jorgenson, Ho and Stiroh 2005; Baldwin and Gu 2007a).

Table 5 presents labour productivity growth, the capital deepening effect and MFP growth in the regulated sector in Canada and the United States over the 1977-to-2003 period. For the total business sector, labour productivity growth and MFP growth were slower in Canada than in the United States, while the capital deepening effect was similar in the two countries. However, for some of the network industries that underwent deregulation in Canada, labour productivity growth and MFP growth in Canada were higher or quite comparable with those in the United States. In addition, the investment and the capital deepening effect in those industries in Canada were also higher than in the United States or comparable to those of similar U.S. industries. Those industries include broadcasting and telecommunications, rail transportation and financial services. For rail transportation and broadcasting and telecommunications, labour productivity growth and MFP growth were similar in Canada and in the United States. For financial services, labour productivity growth was higher in Canada, while MFP growth showed a slower decline than in the United States.

Table 5
Sources of labour productivity growth in Canada and the United States, 1977 to 2003

	Canada			United States		
	Labor productivity	Capital stock per hour worked	Multifactor productivity	Labor productivity	Capital stock per hour worked	Multifactor productivity
	percent					
Transportation and warehousing	1.4	0.1	1.3	1.8	0.1	1.7
Air transportation	0.2	0.8	-0.6	4.6	0.6	4.0
Rail transportation	6.2	1.1	5.1	6.1	1.1	4.9
Broadcasting and telecommunications	4.5	1.6	2.9	4.8	2.1	2.7
Publishing, data processing and information services	0.4	1.5	-1.1	3.1	1.4	1.7
Motion picture and sound recording industries	0.7	0.7	0.0	2.2	0.9	1.4
Financial intermediation	2.7	3.1	-0.4	0.5	2.9	-2.4
Insurance carriers	3.5	4.4	-0.9	0.0	2.0	-2.0
Total business sector	**1.3**	**0.5**	**0.8**	**2.0**	**0.4**	**1.5**

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

The cultural industries and air transportation in Canada had slower labour productivity growth and MFP growth than in the United States. But the capital deepening effect was similar in the two countries. This suggests that the slower labour productivity growth in Canada was due to slower MFP growth, and there was no deficiency in relative investment in those Canadian industries. The cultural and air transportation industries in Canada experienced slower technological progress and slower improvement in production efficiency than did those in the United States.

The slower MFP growth and labour productivity growth in the cultural industries in Canada occurred in a sector that experienced the least deregulation of the industries examined here. Productivity growth in air transportation slowed down during the period when Canada experienced a recession in the early 1990s, the effects of 9/11 and a number of other negative shocks associated with fuel price increases.

Tables 6 and 7 present a Canada–United States comparison of labour productivity growth, the capital deepening effect and MFP growth in two sub-periods: 1977 to 1990 and 1990 to 2003. Overall, the evidence in the two sub-periods is similar to those for the entire 1977-to-2003 period.

Table 6
Sources of labour productivity growth in Canada and the United States, 1977 to 1990

	Canada			United States		
	Labour productivity	Capital stock per hour worked	Multifactor productivity	Labour productivity	Capital stock per hour worked	Multifactor productivity
	percent					
Transportation and warehousing	2.0	0.0	2.0	1.4	-0.3	1.7
Air transportation	3.1	0.8	2.3	1.4	-0.4	1.8
Rail transportation	5.7	1.4	4.3	7.8	1.9	6.0
Broadcasting and telecommunications	5.1	1.4	3.7	4.9	2.3	2.7
Publishing, data processing and information services	0.4	0.7	-0.3	1.0	1.4	-0.3
Motion picture and sound recording industries	1.8	1.6	0.2	4.6	2.5	2.1
Financial intermediation	2.2	4.0	-1.8	0.1	3.8	-3.7
Insurance carriers	5.6	4.3	1.3	-0.1	3.1	-3.2
Total business sector	**1.0**	**0.6**	**0.4**	**1.5**	**0.4**	**1.1**

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

Table 7
Sources of labour productivity growth in Canada and the United States, 1990 to 2003

	Canada			United States		
	Labour productivity	Capital stock per hour worked	Multifactor productivity	Labour productivity	Capital stock per hour worked	Multifactor productivity
	percent					
Transportation and warehousing	0.8	0.2	0.6	2.2	0.4	1.8
Air transportation	-2.6	0.8	-3.4	7.9	1.6	6.3
Rail transportation	6.8	0.8	6.0	4.3	0.4	3.9
Broadcasting and telecommunications	4.0	1.8	2.2	4.6	2.0	2.7
Publishing, data processing and information services	0.4	2.0	-1.7	5.3	1.4	3.9
Motion picture and sound recording industries	-0.4	-0.3	0.0	0.0	-0.6	0.6
Financial intermediation	3.3	2.2	1.1	1.0	2.1	-1.2
Insurance carriers	1.4	4.4	-3.0	0.1	0.9	-0.8
Total business sector	**1.7**	**0.4**	**1.3**	**2.5**	**0.5**	**1.9**

Source(s): Statistics Canada, KLEMS (capital, labour, energy, materials and services) database and CANSIM table 383-0021; Bureau of Economic Analysis.

The contributions of capital deepening and MFP growth to labour productivity growth differ across industries. But the contributions are, in general, similar between the two countries—that is, the main contributor to labour productivity growth is the same in most industries between Canada and the United States. For the financial services sector, capital deepening is more important than MFP growth for labour productivity growth. For rail transportation, and broadcasting and telecommunications, MFP growth and technological progress are more important for labour productivity growth. For the cultural industries and air transportation, the capital deepening effect was similar in the two countries, but Canada had slower MFP growth in those industries.

6 Conclusion

This paper has examined productivity growth in several Canadian regulated industries and compared the results with those in comparable U.S. industries. The evidence shows that many of the Canadian industries that underwent deregulation and opened market entry to competition experienced faster labour productivity growth and multifactor productivity (MFP) growth than the aggregate business sector over the 1977-to-2003 period. While the total business sector had slower productivity growth in Canada than in the United States, most Canadian regulated industries had similar or higher productivity growth relative to their counterparts in the United States. Those industries include rail transportation, broadcasting and telecommunications, financial intermediation and insurance carriers.

The evidence for Canada supports the empirical evidence from the European Union, the United Kingdom and other Organisation for Economic Co-operation and Development countries that suggest that deregulation is associated with higher productivity growth. This comes from reduced barriers to entry, increased competition, and increased incentives to innovation and adoption of advanced technologies such as information technologies.

Over the 1977-to-2003 period, labour productivity grew at an annual rate of 6.2% in rail transportation in Canada, and MFP grew at 5.1% per year. Both labour productivity growth and MFP growth in rail transportation in Canada were higher than in the same U.S. industry. For broadcasting and telecommunications, the growth in labour productivity and MFP was faster than productivity growth in the total business sector in both countries. The growth in capital intensity was also similar in the two countries. For financial intermediation and insurance carriers, labour productivity growth was higher in Canada than in the United States; MFP declined in both countries, but the decline was much slower in Canada than in the United States.

The cultural industries, where there was less deregulation, showed little productivity growth in Canada over the 1977-to-2003 period. In addition, productivity growth in the Canadian cultural industries was slower than in the United States.

The airline industry in Canada had much slower productivity growth than in the United States over the period from 1977 to 2003. Both labour productivity and MFP declined in the Canadian airline industry over the period, while productivity growth in the U.S. airline industry was similar to the growth in the U.S. total business sector.

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